

Barriers to Integration of Local Knowledge in Climate Adaptation Strategies for Liberia's Small-Scale Fisheries

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Abstract

Climate change poses significant challenges to Liberia's small-scale fisheries, a vital sector that contributes 10% to the national GDP and provides over 50% of the population's animal protein. These fisheries are increasingly at risk from climate-related threats such as rising sea levels, ocean acidification, and disruptions to fish migration patterns. However, the potential of local ecological knowledge as a resource for resilience and sustainability remains underused in formal adaptation strategies. This study examined barriers to integrating local knowledge into climate adaptation efforts, focusing on three key fishing areas: West Point, Marshall, and St. Paul Bridge. The analysis identified significant challenges in using a mixed-methods approach, which included quantitative surveys with a sample size of 384 and qualitative interviews. A lack of documentation and transfer of local knowledge was highlighted by 96% of respondents, while limited capacity-building opportunities (40%) and poor knowledge-sharing mechanisms (60%) further hinder adaptation efforts. Additionally, 78% of respondents cited livelihood loss and food insecurity as critical issues, underscoring the sector's vulnerability to climate impacts. To address these barriers, the study recommends establishing strong documentation systems for local knowledge, encouraging inclusive knowledge-sharing platforms, and improving capacity-building initiatives. Aligning adaptation strategies with local ecological contexts is crucial for promoting resilience and sustainability in Liberia's small-scale fisheries.

Keywords

Policy challenges; Participatory challenges; Knowledge; Local communities

Introduction

Climate change is one of the most pressing challenges of the 21st century, with far-reaching consequences for ecosystems, economies, and human well-being. Its effects are especially severe

in developing countries, where adaptive capacity is limited, and livelihoods depend heavily on climate-sensitive sectors. According to the Intergovernmental Panel on Climate Change (IPCC, 2023). Global temperatures have already increased by 1.1°C above pre-industrial levels, intensifying extreme weather events, including droughts, floods, and storms. In sub-Saharan Africa, small-scale fisheries are among the most vulnerable sectors. These fisheries play a critical role in food security, poverty alleviation, and coastal livelihoods.

In Liberia, small-scale fishing supports more than 80% of the population and provides full or part-time employment to approximately 37,000 people (Environmental Justice Foundation, 2020). The sector contributes about 15% to the country's GDP and supplies over half of the national animal protein intake, making it central to both economic and nutritional security (Mehnwon and Leslie, 2022). However, climate-induced changes such as sea-level rise, ocean acidification, erratic rainfall, and disruptions to fish migration patterns are threatening the sustainability of Liberia's fisheries (Muringai, Mafongoya and Lottering, 2022). Integrating effective climate adaptation strategies into Liberia's fisheries sector is necessary to address these challenges. Traditional adaptation approaches often rely on scientific data and top-down methodologies, sidelining the valuable local knowledge held by small-scale fishers. Despite these risks, local fishers possess extensive ecological knowledge gained over generations. This knowledge, covering seasonal patterns, marine biodiversity, and resource management, is vital for adaptation and resilience. Yet, it remains largely excluded from formal climate adaptation frameworks. Liberia's National Adaptation Program of Action (NAPA) acknowledges the threat of climate change but does little to incorporate local ecological knowledge into policy and planning (Hugh, 2024; (LEPA, 2024).

The disconnect is driven by multiple barriers, including weak institutional coordination, limited community engagement, poor communication between policymakers and local actors, and the cultural undervaluation of traditional knowledge systems (Goonesekera and Olazabal, 2022). Moreover, climate policies are often shaped by technocratic and donor-driven priorities that marginalize local voices and prioritize external expertise. These systemic constraints diminish the effectiveness of adaptation strategies and disempower small-scale fishers from participating in decision-making, despite their lived experience and insights into changing environmental conditions. To critically assess these dynamics, this study applies two complementary theoretical frameworks: Knowledge Systems Theory and the Theory of Planned Behavior (TPB). Knowledge Systems Theory focuses on how different forms of knowledge, scientific, institutional, and local, interact in environmental governance. It highlights epistemological hierarchies, institutional biases, and exclusionary practices that hinder collaboration (Atetedaye, 2025).

Ajzen (2024) examines how individual attitudes, social norms, and perceived behavioural control shape actions. In the context of this study, theory of planned behaviour (TPB) helps explain how stakeholders' beliefs and perceptions affect their willingness to integrate or support local knowledge in adaptation planning (Syed *et al.*, 2024). Together, these frameworks reveal how scientific dominance, institutional exclusion, and low perceived agency among local fishers act as significant obstacles to inclusive adaptation. The overarching aim of this research is to evaluate these barriers

and explore participatory approaches that can bridge the gap between traditional and scientific knowledge systems for improved climate governance. Specifically, the study seeks to: (1) identify structural and institutional impediments to integrating local knowledge into formal adaptation strategies; (2) assess the attitudes, beliefs, and perceived behavioural control of both fishers and institutional stakeholders regarding knowledge-sharing and adaptive practices; and (3) propose mechanisms for participatory engagement in climate decision-making. Focusing on three key fishing communities, West Point, Marshall, and St. Paul Bridge, selected for their socio-economic relevance and climate vulnerability, the study employs a mixed-methods approach, combining quantitative surveys ($n = 384$) with qualitative interviews. Preliminary findings indicate that 96% of respondents cite the lack of documentation and formal recognition of local knowledge as a major barrier; 60% point to weak knowledge-transfer mechanisms, and 40% highlight limited access to training and capacity-building opportunities. Furthermore, 78% report livelihood loss and food insecurity as critical challenges linked to climate impacts. The study recommends the establishment of inclusive documentation systems for indigenous knowledge, the development of participatory knowledge-sharing platforms, and expanded capacity-building efforts targeting both local and institutional actors. Aligning adaptation strategies with localized ecological understanding is crucial for fostering resilience in resource-dependent communities. By recognizing the legitimacy of local expertise and facilitating mutual learning between scientific and traditional knowledge systems, this research aims to contribute to the creation of inclusive, context-sensitive adaptation frameworks. Such approaches not only enhance the effectiveness of climate responses but also empower small-scale fishers as active agents in shaping sustainable and equitable futures for Liberia's fisheries sector.

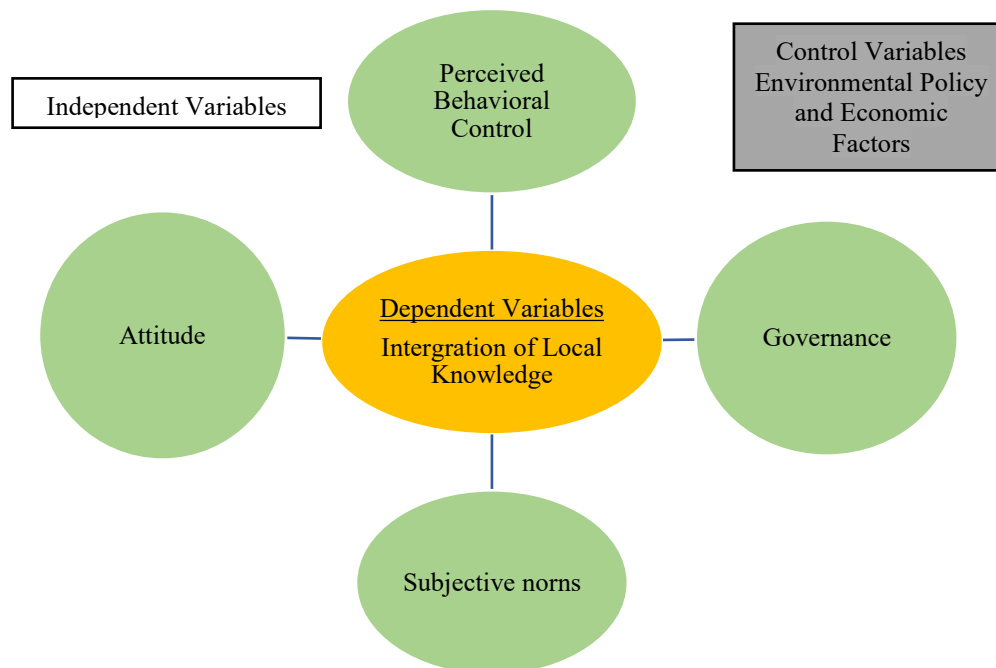


Figure 1: A conceptual framework illustrating the integration of local knowledge, developed by the author and adapted from the Theory of Planned Behavior (Ajzen, 1991), Knowledge Systems Theory, and the Acceptance Model (Ibarra *et al.*, 2022).

Materials and Methods

Study Area

The research was conducted in West Point, a highly populated slum in Monrovia, the capital of Liberia. West Point is situated on a slender peninsula between the Atlantic Ocean and the Mesurado River, at coordinates 6.3234° N, 10.8007° W. The St. Paul Bridge fishing hamlet, located on the periphery of Monrovia adjacent to the St. Paul River, which empties into the Atlantic, is a prominent fishing area at the bridge across the river, with coordinates 6.3806° N, 10.7778° W. Marshall, a coastal municipality in Margibi County southeast of Monrovia, is situated between the Junk and Farmington Rivers, providing access to the Atlantic Ocean at coordinates 6.1367° N, 10.3483° W. Liberia, situated in West Africa on the North Atlantic coast, is bordered by Sierra Leone to the northwest, Guinea to the north, and Côte d'Ivoire to the east. The coastline stretches 560 kilometers (350 miles) along the Atlantic to the south and southwest. Monrovia, the capital, is located on the coast in the central-western part of the country. Liberia is situated geographically between latitudes $4^{\circ}21'N$ and $8^{\circ}33'N$, and longitudes $7^{\circ}22'W$ and $11^{\circ}30'W$. The landscape mostly comprises coastal plains, ascending to rolling hills and a hilly plateau in the northern region, which houses Mount Wuteve, the highest elevation at 1,440 meters (4,724 feet) (WorldAtlas, 2021).



Figure 2: Map of the Study Area Showing Key Locations, West Point, St. Paul Bridge, and Marshall. *Sources:* Environmental Protection Agency (EPA), Liberia Institute of Statistics and Geo-Information Services (LISGIS)

Research Design

A one-month evaluation was performed in three research areas, accompanied by visits to governmental offices and international and local organizations, to assess small-scale fishermen's climate change adaptation tactics. Relevant officials provided information regarding the impact of climate change on small-scale fishing and their comprehension

of the local dynamics influencing these communities. The research employed a cross-sectional methodology to gather Knowledge, Attitudes, and Practices (KAP) data from the three zones. A triangulation strategy was utilized to improve data validity by including several data sources and methodologies. The primary focus was on qualitative analysis (Peters and Khan, 2024). However, quantitative methods were employed to examine correlations between variables. This mixed-methods approach yielded a thorough comprehension of participants' viewpoints and direct experiences, providing significant insights into the obstacles encountered (Wasti *et al.*, 2022).

Data Collection and Analysis

The research used a mixed-methods approach to examine stakeholders' knowledge, attitudes, and behaviours about climate change adaptation strategies, institutional frameworks, and obstacles. Quantitative data were collected via structured surveys and questionnaires, documenting demographic information, awareness of local knowledge, coping techniques, and the amalgamation of local knowledge with scientific research. The appendix-A has detailed questions on institutional frameworks, existing policies, and barriers that small-scale fishers face in adapting to climate change. The sample size was calculated via Cochran's formula, and key informants were selected via purposive sampling (Alemayehu *et al.*, 2023). Qualitative data were gathered through in-depth interviews and focus group discussions, providing profound insights into participants' experiences and perceptions (Saha *et al.*, 2024). Descriptive statistics, including averages, standard deviations, frequency tables, bar charts, and percentages, were employed to summarize quantitative data. Inferential approaches, such as T-tests, regression analysis, and chi-squared tests, yielded population-level results at a 95% confidence level and $P < 0.05$, analyzed via SPSS software (Cooksey, 2020). Thematic and contextual analyses of qualitative data identified repeating patterns, with findings displayed via tables, charts, frequency, and thematic narratives. Together, these methods, complemented by the detailed appendix instrument, offered a comprehensive understanding of the role of local knowledge in climate change adaptation among small-scale fisheries in Liberia (Subair, Prianto and Amri, 2025).

Sample Size

The sample size for this investigation was determined using the Cochran formula, then simplified and modified by (Nanjundeswaraswamy and Shilpa, 2024). The Cochran formula ($N = Z^2pq/e^2$) stipulates that for populations greater than 10,000, a minimum sample size of 384 is adequate. The criterion was achieved with a total population of 172,818 in the three research areas: West Point, Marshall, and St. Paul Bridge. The sample size of 384 was allocated according to the population proportions of each zone: Marshall (25%), West Point (55%), and St. Paul Bridge (20%) to guarantee proportional representation. Furthermore, six important informants were deliberately chosen to offer comprehensive insights (Chelimo, 2022). The research employed Cochran's sampling formula, resulting in a sample size of 384 respondents (Ganesh, 2024).

$$\text{Sample size} = \frac{Z - \text{score}^2 (\text{Standard Deviation})(1 - \text{Standard Deviation})}{\text{Confidence interval}^2}$$

So, using Cochran's sample size formulation above, one gets a sample size of 384. The formula is as follows: $n_0 = \frac{Z^2 (p) (1-p)}{e^2}$

Where:

n_0 = required sample size

Z = Z-score, which corresponds to the desired confidence level (e.g., $Z=1.96$ for a 95% confidence level)

p = estimated proportion of the population (e.g., 0.5 is used as a conservative estimate, meaning there's a 50/50 chance of a respondent possessing a characteristic of interest)

$1-p$ = proportion of the population not having the characteristic (also 0.5 in this case)

e = margin of error (confidence interval), such as 0.05 for a $\pm 5\%$ margin of error

Now, applying the finite population correction: $384 = \frac{0.9604}{0.0025}$
 $n = 384$

Results

This result identifies key barriers to climate change adaptation in small-scale fisheries in Liberia, including a lack of awareness, livelihood loss, food insecurity, and inadequate documentation of local knowledge. The absence of effective knowledge transfers and limited capacity-building initiatives further hinders adaptation efforts. These findings improved awareness, better knowledge sharing practices, and strong policy support to enhance the resilience of small-scale fisheries to climate change.

Lack of awareness as a barrier to Climate Change Adaptation Strategies by Small-scale Fisheries

Figure 3 highlights the lack of awareness as a major barrier to climate adaptation in small-scale fisheries. This figure is based on the data in table 1.

Table 1: Data corresponding to Figure 3: Lack of Awareness as a Barrier to Climate Adaptation in Liberia (Mean = 4.11, Standard Deviation = 0.75)

<i>Perceptions</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Strongly Disagree	6	1.56%
Disagree	9	2.34%
Neutral	25	6.51%
Agree	242	63.02%
Strongly Agree	102	26.56%

Most respondents (88%) agree or strongly agree that insufficient awareness impedes effective adaptation efforts, while only 3% disagree or strongly disagree, suggesting that few consider other factors more critical. The mean score of 4.11 indicates a strong consensus among respondents, with a standard deviation of 0.75, reflecting minimal variability in their views. These findings emphasize that most participants recognize awareness as crucial in enhancing climate adaptation strategies. They underscore the need for targeted educational initiatives to improve understanding of climate change impacts. By raising awareness,

communities can better integrate local knowledge into adaptation efforts, ultimately enhancing the resilience of small-scale fisheries to environmental changes.

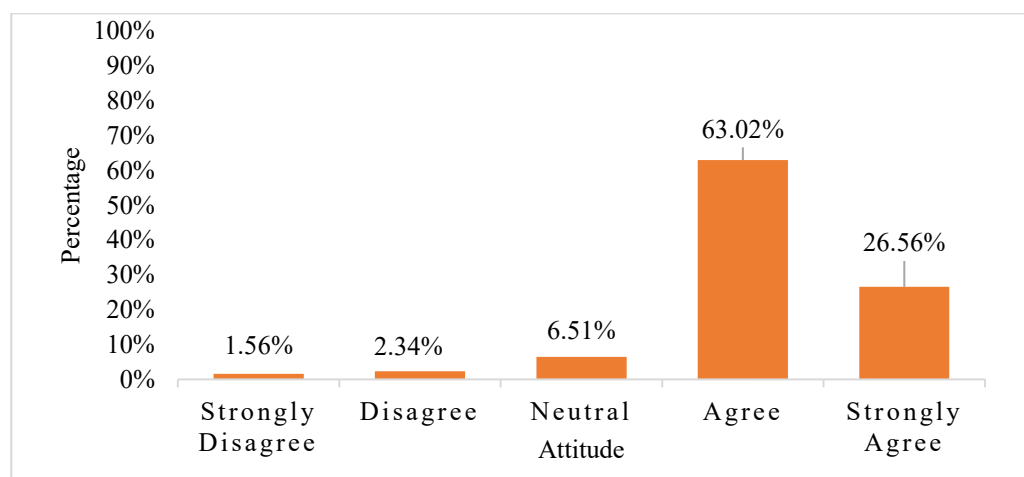


Figure 3: Lack of Awareness as a Barrier to Climate Adaptation in Liberia

Key Barriers to Climate Change Resilience by Small-scale Fisheries

Similarly, table 2 depicts key barriers to resilience identified by respondents in small-scale fisheries. Livelihood loss and food insecurity due to climate change were reported by 78% of respondents as the most critical challenges undermining the sector's ability to adapt to environmental changes. Limited resources and capacity-building opportunities were cited by 40% as significant obstacles to resilience (also see Figure 4). Meanwhile, vulnerability to extreme weather events was noted by 35%, and coastal habitat degradation was identified by 30% as a major issue affecting fisheries' long-term sustainability. An additional 20% of respondents highlighted shifting fish stocks and changes in species composition as challenges driven by climate variability. Social and cultural impacts on fishing communities were recognized by 17%, reflecting broader socio-economic concerns. Lastly, regulatory and governance issues were noted by 4% of respondents, indicating gaps in policy and institutional support that hinder the sector's stability. These findings reveal the multifaceted nature of the barriers confronting small-scale fisheries and emphasize the need for integrated, adaptive strategies that address environmental and socio-economic challenges to strengthen their resilience and sustainability.

Table 2: Data corresponding to Figure 4: Barriers to small-scale fisheries resilience in Liberia

<i>Barrier</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Loss of livelihoods and food security	300	78%
Limited resources and capacity	154	40%
Vulnerability to extreme weather events	134	35%
Degradation of coastal habitats	115	30%
Shifting fish stocks and species composition	77	20%
Social and cultural impacts	65	17%
Regulatory and governance challenges	15	4%

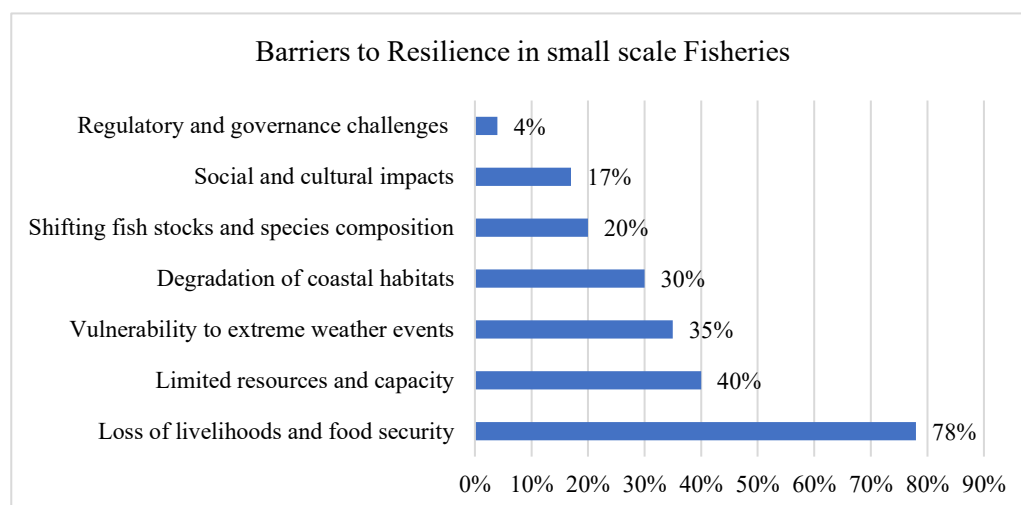


Figure 4: Barriers to Small-Scale Fisheries Resilience in Liberia

Challenges in Documenting and Transmitting Local Knowledge

Table 3 and figure 5 show that the most significant challenge, identified by 96% of respondents, is the inadequate documentation and transmission of local knowledge, which jeopardizes the preservation of traditional practices due to poor record-keeping and weak knowledge-sharing systems. Additionally, 7% of respondents cited resistance to change within the sector, while 3% pointed to misalignment with external interventions. Limited recognition and integration of local knowledge were noted by 2% of respondents, and 1% raised concerns about power dynamics and the marginalization of the sector. These findings underscore the urgent need for systematic documentation, enhanced knowledge-sharing, and stronger collaboration between local fishers and policymakers to ensure the effective integration of traditional ecological knowledge into climate adaptation strategies.

Table 3: Data corresponding to Figure 5: Barriers to Local Knowledge Adaptation in Small-Scale Fisheries in Liberia

<i>Barrier</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Lack of Documentation and Transmission	367	96%
Resistance to Change	27	7%
Mismatch with External Interventions	12	3%
Limited Recognition and Integration	8	2%
Power Dynamics and Marginalization	4	1%

Insufficient Documentation as a Barrier to Local Knowledge Integration

Next, the table 4 highlights that insufficient documentation is a major barrier to integrating local knowledge into climate change adaptation efforts in small-scale fisheries. An overwhelming majority of respondents (89%) agree or strongly agree that the lack of proper documentation limits the effective use of traditional ecological knowledge, with a mean response of 4.15 (SD = 0.74), reflecting a strong consensus.

Whereas only 3% of respondents disagree or strongly disagree, indicating that a small minority believe local knowledge can still be applied despite inadequate documentation (see Figure 6). These findings emphasize the critical need for systematic documentation and preservation of traditional ecological knowledge. Developing structured knowledge-sharing mechanisms will facilitate their integration into climate adaptation strategies, ensuring that invaluable local insights are preserved and readily accessible to support resilience-building in small-scale fisheries.

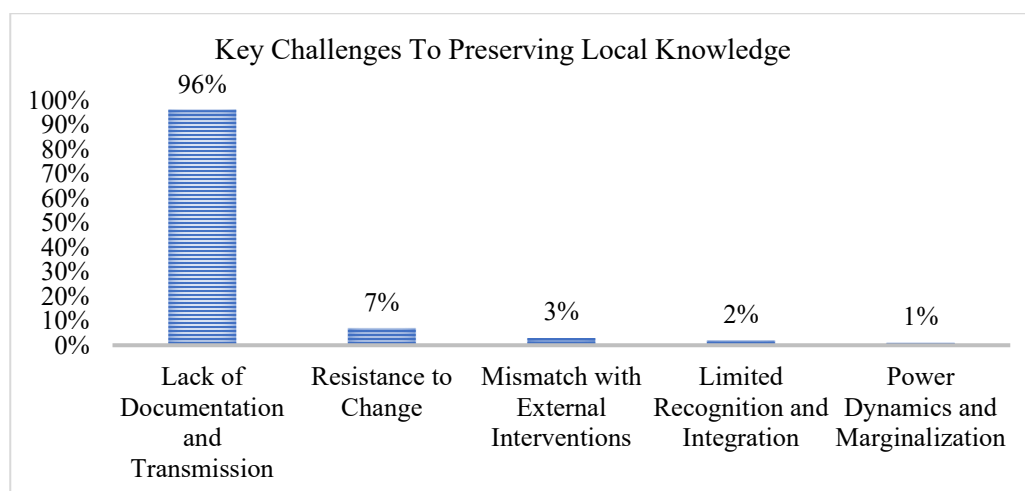


Figure 5: Barriers to Local Knowledge Adaptation in Small-Scale Fisheries in Liberia

Table 4: Data corresponding to Figure 6: Attitudes toward local knowledge adaptation (Mean = 4.15, Standard Deviation = 0.74)

<i>Attitude</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Strongly Disagree	4	1.0%
Disagree	9	2.3%
Neutral	29	7.6%
Agree	226	58.9%
Strongly Agree	116	30.2%

Challenges in Integrating Local Knowledge into Climate Adaptation

Table 5 and figure 7 highlight significant challenges in integrating local knowledge into climate change adaptation strategies for small-scale fisheries. A substantial majority of respondents (79%) agree or strongly agree that this integration remains a barrier, underscoring the need for more effective mechanisms to document, validate, and incorporate traditional ecological knowledge into broader adaptation frameworks. In contrast, 17% of respondents disagree or strongly disagree, suggesting that some believe local knowledge can be effectively integrated into climate adaptation efforts using existing practices. These findings emphasize the importance of overcoming integration barriers to fully leverage local knowledge in enhancing the resilience of small-scale fisheries. Addressing these challenges can bridge the gap between traditional practices

and modern adaptation strategies, fostering more sustainable and locally relevant responses to climate change impacts.

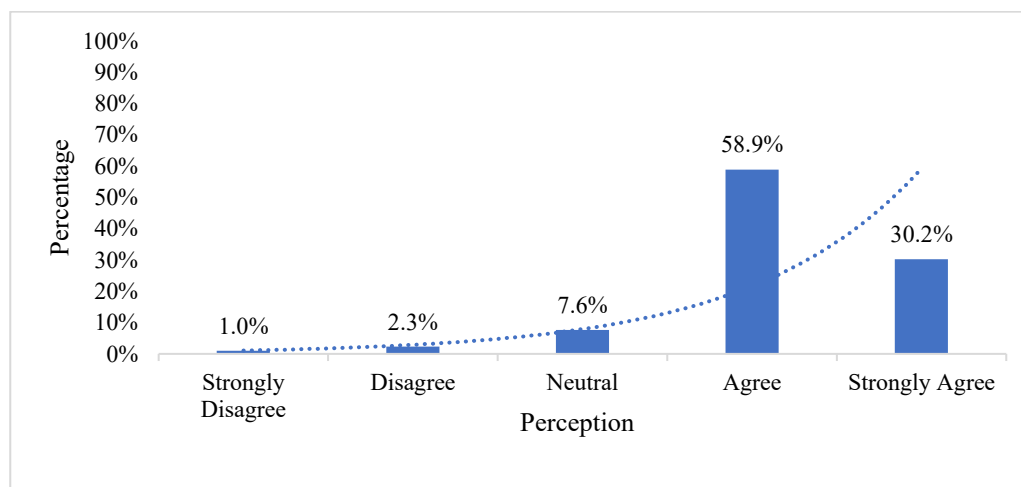


Figure 6: Documentation Challenges in Local Knowledge Adaptation in Liberia

Table 5: Data corresponding to Figure 7: Challenges in Integrating Local Knowledge for Climate Adaptation in Liberia: (Mean = 3.73, Standard Deviation = 1.01)

<i>Perception</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Strongly Disagree	17	4.4%
Disagree	50	13%
Neutral	17	4.4%
Agree	241	62.8%
Strongly Agree	59	15.4%

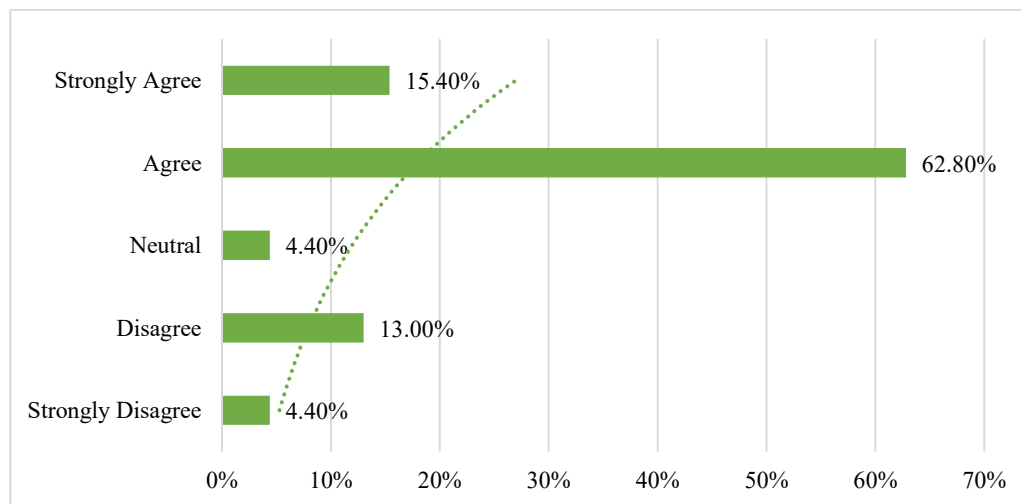


Figure 7: Challenges in Integrating Local Knowledge for Climate Adaptation in Liberia

Impact of Knowledge Transfer on Climate Adaptation

With the table 6, figure 8 highlights the impact of knowledge transfer mechanisms on the implementation of climate change adaptation strategies in small-scale fisheries. Many respondents (60%) agree or strongly agree that the absence of effective knowledge transfer mechanisms has contributed to the poor implementation of climate change initiatives. In contrast, 31% of respondents disagree or strongly disagree, indicating that some participants believe other factors may be more critical to addressing implementation challenges. The mean score of 3.63 reflects a general trend toward agreement, while the standard deviation of 1.04 indicates some variability in respondents' perspectives. These findings underscore the importance of establishing robust knowledge transfer systems to ensure that traditional ecological knowledge is effectively shared and utilized within communities. Strengthening these mechanisms can significantly enhance climate resilience by promoting the practical application of local knowledge in adaptation efforts, ultimately bridging the gap between knowledge holders and implementers in small-scale fisheries.

Table 6. Data corresponding to Figure 8: Impact of Knowledge Transfer Mechanisms on Climate Change Implementation: (Mean = 3.63, Standard Deviation = 1.04)

<i>Attitude</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Strongly Disagree	16	4.20%
Disagree	63	16.40%
Neutral	22	5.70%
Agree	230	59.90%
Strongly Agree	53	13.80%

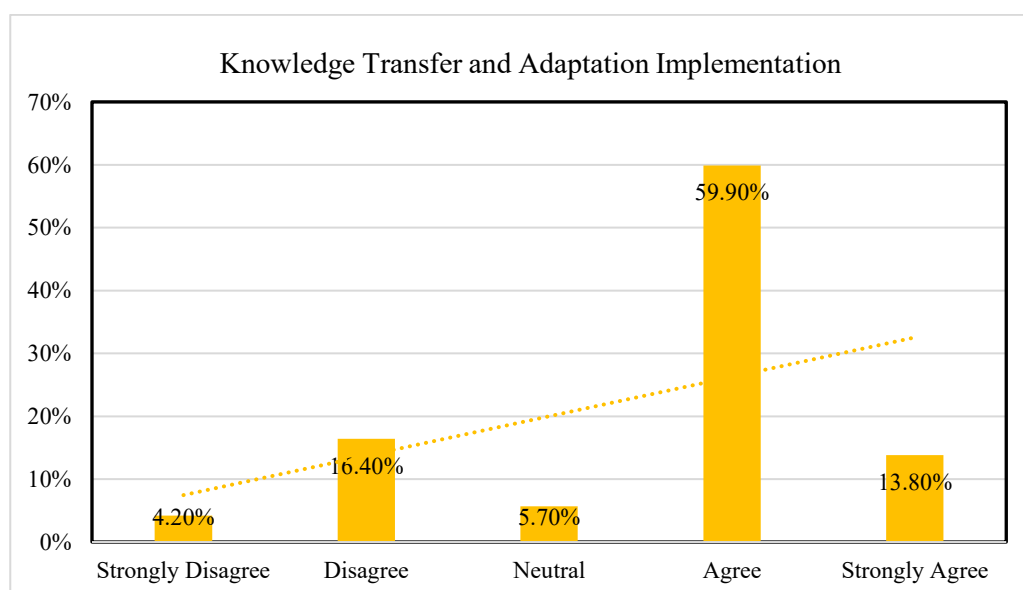


Figure 8: Impact of Knowledge Transfer Mechanisms on Climate Change Implementation

Perceptions of the Capacity Building Initiative for Climate Change Adaptation

Figure 9 based on data in table 7 illustrates mixed perceptions regarding the effectiveness of capacity-building initiatives aimed at supporting climate change adaptation in small-scale fisheries. 42% of respondents agree or strongly agree that these initiatives have been implemented, while 24% remain neutral, suggesting limited awareness or inconsistent experiences with their effectiveness. In contrast, 35% of respondents disagree or strongly disagree, indicating that a significant portion of participants perceive these programs as insufficient or lack meaningful impact. The mean score of 2.97 reflects a slight lean toward disagreement, with a standard deviation of 1.27, pointing to diverse opinions among respondents. These findings emphasize the need for more effective, widely recognized capacity-building programs that directly address the challenges faced by small-scale fisheries. Strengthening these efforts can enhance the adaptive capacity of fisheries, ensuring they are better prepared to respond to the impacts of climate change and promote sustainable practices.

Table 7: Data corresponding to Figure 9: Effectiveness of Capacity-Building Initiatives in Small-Scale Fisheries: (Mean = 2.97, Standard Deviation = 1.27)

<i>Attitude</i>	<i>Number of Respondents</i>	<i>Percentage (%)</i>
Strongly Disagree	73	19%
Disagree	60	15.60%
Neutral	94	24.50%
Agree	120	31.30%
Strongly Agree	37	9.60%

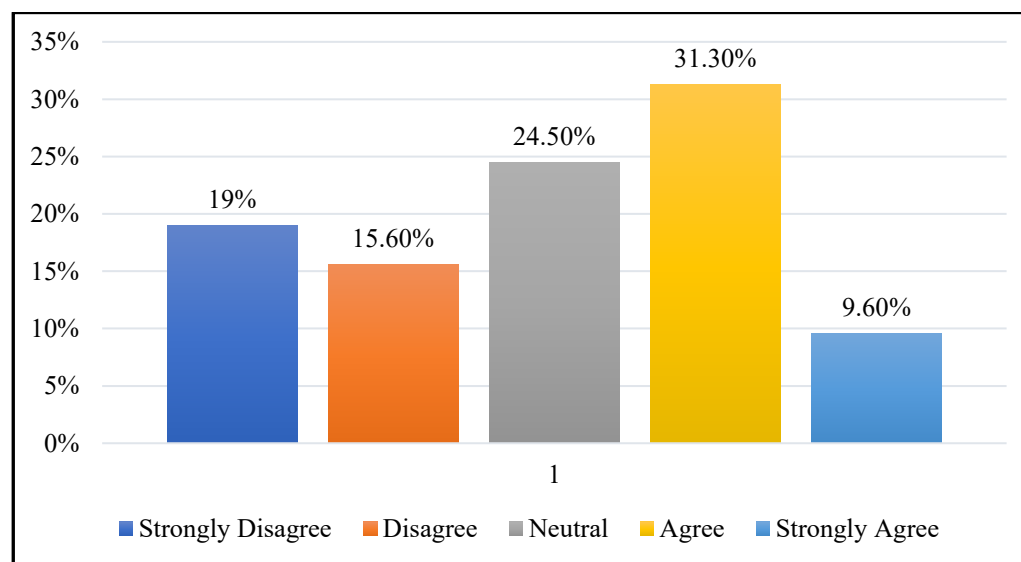


Figure 9: Effectiveness of Capacity-Building Initiatives in Small-Scale Fisheries

Perceptions of Policy Challenges in Climate Change Adaptation for Small-Scale Fisheries in Liberia

Table 8 highlights respondents' perceptions of policy-related challenges in advancing climate adaptation efforts within small-scale fisheries in Liberia. A large majority (83%) agree that small-scale fisheries have limited coping strategies to adapt to climate change, indicating an urgent need for targeted support and policy interventions to enhance their adaptive capacity. Additionally, 68% of respondents identify a lack of political will as a major barrier to the development and implementation of effective adaptation strategies, highlighting the importance of government commitment to drive meaningful change. Notably, 62% of respondents view overfishing by humans as a greater threat to fish populations than environmental changes, underscoring the need to address human-induced pressures in parallel with climate adaptation efforts. Furthermore, 72% of respondents agree that poor implementation of adaptation strategies is primarily due to insufficient local knowledge transfer, emphasizing the critical need for knowledge-sharing mechanisms within fishing communities to ensure that local ecological knowledge is effectively utilized in adaptation processes. The mean score of 4.11 indicates a strong consensus toward agreement, while the standard deviation of 0.75 reflects low variability in responses. These findings stress the importance of comprehensive policies that address both human and environmental factors, along with educational initiatives to raise climate change awareness. Strengthening knowledge transfer systems and integrating local knowledge into policy frameworks can significantly enhance the resilience of small-scale fisheries to climate-related challenges and improve the effectiveness of adaptation strategies at the community level.

Table 8: Perceived Significance of Policies for Climate Adaptation

<i>Parameter</i>	<i>Agree (Positive) %</i>	<i>Disagree (Negative) %</i>
There are limited Coping Strategies for small-scale Fisheries to adapt to Climate Change in Liberia	83± 0.33 ^a	17± 0.33 ^a
The issue of political will in climate change adaptation strategies has been a problem	68± 0.18 ^a	32± 0.18 ^a
Overfishing by humans has had a more significant impact on fish populations than environmental changes	62± 0.12 ^a	38± 0.12 ^a
Local knowledge transfer has led to poor implementation of climate change adaptation strategies by small-scale fisheries	72 ± 0.22 ^a	28 ± 0.22 ^a

Notes: ^{a, b}: Different letters in the same row differ statistically by Chi-Square, $p < 0.05$; Positive: respondents agree on the significance of policies in climate change adaptation in the small-scale fishing sector of Liberia. Negative: respondents on the opposite views of the positive responses

Discussion

This study explores the integration of local knowledge into climate change adaptation strategies for small-scale fisheries in Liberia. Findings reveal that major barriers to effective adaptation stem from limited recognition and integration of traditional ecological knowledge (TEK). Weak policy support, inadequate capacity-building, and insufficient training limit both community and institutional ability to document and apply indigenous knowledge. Additionally, poor knowledge transfer, due to a lack of intergenerational learning platforms and weak collaboration between traditional and scientific systems, further restricts the role of TEK in building community resilience.

This discussion situates the findings within the broader literature on climate change adaptation, local knowledge, and small-scale fisheries to provide a holistic understanding of these challenges. One critical issue is the widespread lack of climate change awareness among Liberia's small-scale fishers, identified by 88% of respondents as a major barrier. Liberia's low adult literacy rate (48.3%), alongside persistent disparities among women and rural populations, reflects entrenched educational challenges shaped by civil conflict, poor infrastructure, and socioeconomic barriers. While youth literacy stands at 77.5%, limited access to quality education restricts the ability to engage with climate information documents independently, and the absence of structured climate awareness programs continues to hinder the effective dissemination and understanding of climate-related information (Bliss, 2024). This educational and awareness gap significantly undermines community resilience and adaptation efforts (Zakeer and Allah, 2024).

Many fishers rely primarily on traditional knowledge, making it difficult to detect slow-onset climate change. The absence of government-led climate education exacerbates knowledge gaps, as climate topics remain poorly integrated into formal education, adult learning, civic programs, and agricultural extension services. This is despite, for instance, a substantial proportion of the population relying on climate-sensitive economic sectors, such as fisheries, for livelihoods. As a result, both youth and adults lack the necessary tools to understand and respond to climate risks, weakening grassroots adaptive capacity. Strengthening extension services, such as those provided by the National Fisheries and Aquaculture Authority (NaFAA), could help bridge this gap. Although currently limited, such services offer a direct pathway to promote adaptive practices, climate literacy, and the integration of local governance. Tailored outreach, culturally appropriate communication strategies, and collaboration with local leaders can build awareness and foster adaptive responses (Filho *et al.*, 2024b).

Traditional fishing methods are often perceived as unsustainable, but many artisanal practices, such as the use of selective gear, seasonal harvesting, and community-enforced no-fishing zones, closely align with sustainable resource management principles (Yadav *et al.*, 2024). However, these practices often remain static and are not sufficiently updated to address emerging climate risks, including shifting fish migration routes, rising sea surface temperatures, and the growing intensity of extreme weather events. In Liberia, for instance, the continued use of fixed fish traps, or "brush parks," is both locally accepted and environmentally low-impact, yet their effectiveness may decline under changing oceanic conditions. A viable enhancement would be the introduction of

community-based fish monitoring systems that incorporate mobile technologies and participatory mapping to track ecological changes (Ramirez, Juan and Makoto, 2022).

To facilitate this transition, local fishing cooperatives and traditional leaders could partner with NGOs and government institutions to co-develop training initiatives. Effective dissemination could be achieved through radio programming, mobile learning applications, and culturally appropriate community workshops, approaches that have proven successful in similar settings for building adaptive capacity and enhancing knowledge exchange (Wanjue, 2023). The real issue lies in the lack of accessible, updated education that merges sustainability with climate awareness. Strengthened extension services that integrate TEK and climate science can support informed decision-making while preserving cultural heritage. Although the importance of climate education and political commitment in fostering resilience is well recognized, the analysis would benefit from direct reference to Liberia's National Adaptation Plan (NAP) or other relevant policy frameworks that define the country's institutional strategies and climate adaptation priorities.

According to 83% of respondents, limited coping strategies and, as noted by 68%, a lack of political will are key barriers to adaptation. Inadequate coping mechanisms increase vulnerability and dependency on unsustainable practices. Eriksen *et al.* (2021) argue that weak mechanisms, such as insufficient early warning systems, poor infrastructure, and marginalization of local knowledge, amplify climate impacts. Similarly, Melore and Nel (2020), emphasize how governance gaps and policy inertia impede adaptation progress. In Liberia, political will entails a sustained commitment by leaders at all levels to prioritize adaptation, allocate funding, support local institutions, and promote indigenous practices. While distinct from governance structures, political will is essential for activating and sustaining these systems (Beisheim *et al.*, 2025). Without it, adaptation is hampered by policy silence, underfunding, token community participation, donor dependency, implementation delays, and poor coordination (Boston *et al.*, 2024).

Addressing these issues requires not only strengthening local coping strategies but also securing long-term political support. These findings align with existing literature on climate adaptation in developing countries. Nyiawung *et al.* (2022) highlight the systemic nature of these barriers, while Mathew *et al.* (2024), note that small-scale fisheries often lack the tools and resources to adapt effectively. Mwenje and Kumar (2024) further emphasize that strong governance and institutional commitment are prerequisites for successful adaptation. In Liberia, the integration of traditional knowledge into climate adaptation efforts remains insufficient, mainly due to weak and poorly coordinated governance structures that do not support inclusive and participatory frameworks. This governance gap hinders the effective use of indigenous and local knowledge systems, which are crucial for developing contextually appropriate adaptation strategies, especially in climate-sensitive sectors like small-scale fisheries. Recent research shows that without strong institutional arrangements, traditional knowledge is often overlooked, weakening community-led resilience efforts (Mekonnen *et al.*, 2021). Enhancing participatory governance, coupled with coherent policy integration, is critical to mainstreaming traditional knowledge in national and sub-national adaptation planning (Kangacepe *et al.*, 2025).

Without inclusive, decentralized governance structures, indigenous practices risk being used superficially rather than substantively (Fischer, 2021). A major challenge is the lack of documentation and sharing of local ecological knowledge, identified by 88% of respondents as a key barrier. This supports earlier research stressing that the erosion of TEK due to insufficient documentation undermines community adaptation (Filho *et al.*, 2024a). Local fishing communities, supported by governments and NGOs, must take the lead in systematically recording and preserving traditional knowledge. Researchers and development agencies should ensure these efforts are culturally appropriate, inclusive, and linguistically accessible. Producing bilingual resources and using local languages can enhance accuracy and dissemination (Mekonnen *et al.*, 2021).

Currently, Liberia lacks structured systems for documenting TEK, creating a disconnect between indigenous practices and formal adaptation planning. By contrast, countries like Ethiopia have demonstrated success through participatory mapping, digital repositories, integration with scientific research, and supportive policies. Ethiopia's Konso and Gedeo agroforestry systems exemplify the value of such formalized approaches (Mekonnen *et al.*, 2021). These cases highlight the need for culturally grounded, institutionalized frameworks for TEK documentation and application. To close this gap, Liberia should promote community-driven initiatives in partnership with academic institutions. Collaborative documentation efforts involving local communities, government agencies, and NGOs can facilitate the integration of indigenous knowledge into formal policies. Evidence from sub-Saharan Africa and South Asia confirms that systematic documentation is essential for effective adaptation (Mnukwa, Mdoda and Mudhara, 2025). Furthermore, 60% of respondents cited poor knowledge transfer as a major barrier to adaptation. This includes inadequate exchange platforms, language barriers, and the exclusion of TEK from formal plans. Effective knowledge transfer is linked to increased adoption of sustainable practices, improved climate resilience, and deeper local engagement. Yet, traditional knowledge may be sidelined if modern exchange systems fail to be inclusive (Bridges *et al.*, 2024). In Liberia, the lack of inclusive platforms suggests that TEK is not sufficiently integrated into broader climate strategies. The observed variability in community responses ($SD = 1.04$) reflects uneven climate awareness and understanding, which hinders widespread adoption of best practices. Comparative studies in Nepal and Kenya demonstrate how education levels, gender, and other demographic factors influence climate awareness and adaptation behaviors). Such disparities reduce collective action and weaken overall resilience (Vandrevale *et al.*, 2024). Ensuring equitable access to information and inclusive engagement is critical to improving adaptation outcomes.

Finally, overfishing was perceived by 62% of respondents as a more immediate threat than climate change. This perception reflects direct, observable impacts such as reduced catches. However, overfishing and climate change are intertwined. The latter affects fish migration, reproduction, and ocean conditions, compounding stress on marine ecosystems (Mandal and Mandal, 2024). Addressing these interconnected issues requires a comprehensive approach: implementing science-based catch limits, creating alternative livelihoods, integrating local knowledge into policymaking, and raising awareness of long-term climate risks. While 38% of respondents disagreed that overfishing was a greater concern than climate change, the findings suggest a divided perception. Additionally, 60% agreed that poor knowledge transfer contributes to weak climate initiatives, while 31%

disagreed, indicating that multiple factors may be at play. The mean response of 3.63 and SD of 1.04 reflect general agreement with some variability. These results reinforce the need for robust, inclusive knowledge transfer systems that ensure TEK is preserved, shared, and used effectively in climate adaptation planning.

Conclusion

This study identifies significant governance-related and systemic barriers to integrating Traditional Ecological Knowledge (TEK) into climate change adaptation strategies for Liberia's small-scale fisheries. Key challenges include inadequate documentation and knowledge transfer systems, limited coping mechanisms, weak institutional coordination, and insufficient political commitment, with 72% of respondents citing poor knowledge transfer and 68% pointing to limited political will as major impediments. Despite TEK's crucial role in sustainable resource management, its integration into formal adaptation strategies remains minimal due to weak participatory structures, limited capacity building, and the absence of inclusive, decentralized policy frameworks, further compounded by education disparities, funding constraints, and fragmented institutional support. Addressing these challenges requires embedding TEK into governance frameworks at national and local levels by formally aligning climate policies, including the National Adaptation Plan and fisheries policies, with community-based practices. This demands coordinated efforts among government, civil society, and local stakeholders to ensure that traditional knowledge informs decision-making and supports context-specific, resilient adaptation measures. Systematic, culturally appropriate, and bilingual mechanisms for documenting and sharing TEK, such as digital repositories, community-managed archives, participatory mapping, intergenerational dialogues, and peer learning forums, are vital to preserving and applying this knowledge across generations. Expanding capacity-building and extension services, particularly through institutions like the National Fisheries and Aquaculture Authority, is also critical for enhancing adaptive capacity by integrating traditional and scientific knowledge, promoting sustainable fisheries practices, and equipping communities with the skills and tools to respond effectively to climate impacts. Enhancing climate adaptation in Liberia's fisheries is, therefore, not only a technical and environmental challenge but fundamentally a governance imperative that requires collaborative, inclusive, and culturally grounded solutions.

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Appendix-A

Assessment of Climate Change adaptation Strategies through Local Knowledge by Small-Scale Fisheries in Liberia

Good morning/afternoon, my name is Dekontee O. Saytarkon, a student undertaking a Doctor of Philosophy degree in Climate Change Adaptation at the University of Nairobi. My research seeks to assess the climate change adaptation strategies through local knowledge by small-scale fisheries in Liberia. Small-scale or artisanal fishing is distinguished by using conventional fishing methods carried out by individual households rather than large-scale commercial businesses. The approach requires little financial and physical resources, a limited fleet of fishing boats, short fishing expeditions near the coastline, and a major focus on local consumption.

General Objective

The study seeks to assess the climate change adaptation strategies through local knowledge by small-scale fisheries in Liberia.

Specific Objectives

To analyze adaptation strategies of climate change through local knowledge by small-scale fisheries in Liberia

1. To evaluate the institutional framework for adaptation strategies of climate change through local knowledge by small-scale fisheries in Liberia
2. To evaluate barriers to knowledge of local climate change adaptation strategies of small-scale fishing communities in Liberia

I request that you permit me to interview you to learn more about your experience, insights, and knowledge concerning climate change impacts on small-scale fisheries. Your participation is entirely voluntary, and you may decide not to answer any or all of the questions asked. The responses you give will only be used for academic purposes. You will be anonymized so that you cannot be identified. You can also withdraw from the interview at any time. Can we proceed with our interview? "Yes | "No"

Section A: Personal Information

1. Name:(Optional)
.....
2. Age:
 " 18years- 35 years " 36 years- 45years " 46yers- 55 years
 " 56 years –65years " 66years and above
3. Gender: " Male, " Female, " Other
4. Marital status: " Single " , Married " , Widowed, " Divorced
5. County..... Sub County:
 Ward Village
6. When did you start living here?
7. Highest level of education: ☐ Primary, Secondary, Tertiary (Colleges & Universities), None

Section B:

General Objective 1. Analyze adaptation strategies of climate change through local knowledge by small-scale fisheries in Liberia

Do you know what climate change is? Yes " No "

Give reasons for your answer

1. Has climate change impacted, small-scale fisheries sector? Yes " No "

If yes, tick the impact that you know

" Change in fish behavior

" Shifts in fish distribution

" Loss of habitat

" Sea level rise

" Regulatory challenges

" Extreme weather event

Any other way? _____

2. How has climate change impacted your livelihood within the small-scale fisheries sector?

" *Changes in Fish Availability:* Climate change can alter ocean temperatures and currents, leading to shifts in the distribution and abundance of fish species

" *Loss of Fishing Grounds:* Rising sea levels and coastal erosion, intensified by climate change, can lead to the loss of fishing grounds

" *Increased Frequency of Extreme Weather Events:* Climate change is associated with more frequent and intense extreme weather

" *Impact on fishing Seasons:* Climate change can disrupt traditional fishing seasons and patterns

" *Increased Costs:* investing in new technologies to mitigate risks and maintain productivity

Any other way? _____

What are small-scale fisheries doing to cope with their livelihood as it relates to climate change adaptation?

3. What are some of the coping mechanisms used by the small-scale fisheries sector in adapting to climate change?

" *Traditional Ecological Knowledge:* Small-scale fishermen often possess valuable traditional knowledge about local ecosystems, fish behavior, and weather patterns.

" *Community-Based Resource Management:* Collaborative management initiatives that empower local communities to collectively manage fisheries resources and adapt to climate change impacts.

" *Policy Advocacy and Governance Reform:* Fishers advocate for policies and governance structures that support climate change adaptation and sustainable fisheries management.

" *Capacity Building and Training:* Provide small-scale fishers with the knowledge and skills needed to adapt to climate change

“ *Access to Climate Information*: Timely and accurate climate information enables fishers to make informed decisions about fishing activities.

Any other way? _____

4. Do you have any understanding of what is local climate change adaptation knowledge?

Yes “ No “

What is local knowledge?

5. Is local knowledge significant in coping with climate change? Yes No
if yes, what is the significance?

“ *Adapting fishing practices*: Guides fishermen in adapting their fishing practices to changing environmental conditions.

“ *Predicting Weather Patterns*: Includes traditional methods for predicting weather patterns and ocean conditions.

“ *Navigating Local Waters*: Ensure navigation routes that are essential for safe and efficient fishing operations

“ *Conserving Resources*: Often incorporates traditional conservation practices

Any other? _____

6. Which of these local knowledge strategies do you use to adapt to climate change?

“ *Observational Skills*: Fishers rely on keen observational skills honed over years of experience to detect changes in weather patterns, ocean currents, and fish behavior.

“ *Traditional Forecasting Methods*: Many fishing communities have developed traditional methods based on local environmental indicators.

“ *Seasonal Calendars*: Local calendars based on traditional ecological knowledge mark important seasonal events related to fishing, such as the timing of fish migrations, spawning seasons, or optimal fishing periods.

“ *Customary practices*: Incorporate adaptive strategies for coping with environmental variability.

“ *Community-Based Adaptation*: Fishing communities used adaptation initiatives to address shared challenges posed by climate change

“ *Knowledge sharing and learning networks* within and among fishing communities facilitate the exchange of information and best practices for climate change adaptation

Any other way? _____

7. How effective are these adaptation strategies in the impact of climate change?

“ *Integration of Traditional Knowledge and Scientific Expertise*: Strategies that integrate local fisheries knowledge with scientific expertise are more effective in adapting to climate change.

“ *Community Engagement and Participation*: Strategies that involve active participation and engagement of local fishing communities and building resilience to climate change impacts

“ *Governance and Policy Frameworks*: The effectiveness of local fisheries strategies is influenced by governance structures and policy frameworks that shape decision-making processes and resource allocation.

Any other way? _____

8. What are your thoughts about climate change's impact on the small-scale fisheries sector?

- “Threaten the sustainability of fisheries,
- “Jeopardize fishermen's livelihoods and their income
- “Undermine the resilience of coastal communities

Any other? _____

No.	Statements	SD	D	N	A	SA
9.	Climate change is impacting small-scale fisheries in the region					
10.	There is coordination among institutions as it relates to climate change adaptation strategies.					
11.	Local knowledge is significant in coping with climate change's impact					
12.	Small-scale fisheries have adopted these coping strategies for coping with climate change's impact					
13.	The effects of climate change have led to a reduction in fish catch					
14.	Local adaptation strategies have enhanced the resilience of fisheries to climate change impacts.					

Objective 2: Evaluate the institutional framework for adaptation strategies of climate change through local knowledge by small-scale fisheries in Liberia.

15. Which institution is mandated for climate change adaptation within the small-scale fisheries sector?

- “National Fisheries and Aquaculture Authority (NaFAA)
- “Ministry of Agriculture - Fisheries Division
- “Environmental Protection Agency
- “Liberia Maritime Authority
- “Liberia Artisanal Fishermen Association
- “Non-Governmental Organizations (NGOs) working in fisheries development
- “Local Fisheries Cooperation
- “Forestry Development Authority

Any other? _____

16. Have you been trained by any of the following institutions on climate change adaptation of local knowledge? Yes No

If yes, tick any of the institutions below.

- “National Fisheries and Aquaculture Authority (NaFAA)
- “Ministry of Agriculture - Fisheries Division
- “Environmental Protection Agency
- “Liberia Maritime Authority
- “Liberia Artisanal Fishermen Association
- “Non-Governmental Organizations (NGOs) working in

fisheries development

" Local Fisheries cooperation

" Forestry Development Authority

Any other? _____

17. Are there any policies to address local knowledge of climate change adaptation strategies?

"Yes "No,

If yes, tick the policy that you know

" National Adaptation Policy Plan "Yes "No

" National Determinant Contribution "Yes "No

" National Policy and Response Strategies on Climate Change "Yes "No

" National Fisheries and Aquaculture Policy and Strategy "Yes "No

Any other? _____

18. Do you have legislation that benefits from the use of local knowledge on climate change adaptation?

"Yes "No,

If yes, tick the legislation that you know

" *National Adaptation Plans*: Liberia has developed National Adaptation Plans (NAPs) to address climate change impacts across various sectors, including agriculture, forestry, and coastal management.

" *Community-Based Adaptation*: Liberia promotes community-based adaptation approaches that empower local communities and implement adaptation measures that suit specific needs.

" *Environmental Laws and Policies*: The enactment of environmental laws and policies that recognize the value of traditional knowledge in natural resource management and conservation

" *Participation and Consultation*: Emphasizes stakeholder participation and consultation

" *Capacity Building and Awareness*: Building capacity and raising awareness about climate change adaptation often include initiatives to strengthen the understanding of local knowledge and practices.

Any other? _____

No.	Statements	SD	D	N	A	SA
19.	There are climate change adaptation policies within the small-scale fisheries sector					
20.	Local fisheries have been taught about climate change adaptation strategies in the fisheries					
21.	Local knowledge has been used in developing policy as it relates to climate change adaptation					
22.	Local fisheries have adapted or followed the existing laws for climate change adaptation					
23.	Policies are in place to address climate change adaptation in the small-scale fishing sector					
24.	Local adaptation strategies have prevented small-scale fisheries from climate change impact					

Objective 3 To Evaluate barriers to the knowledge of local climate change adaptation strategies of small-scale fishing communities in Liberia

25. What are the existing challenges facing climate change adaptation in the small-scale fisheries sector?

“ *Social and Cultural Impacts*: Climate change is having significant social and cultural impacts on small-scale fishing communities, disrupting traditional fishing practices and cultural identities.

“ *Regulatory and Governance Challenges*: Small-scale fisheries often face regulatory and governance challenges that hinder their ability to adapt to climate change

“ *Degradation of Coastal Habitats*: Coastal habitats such as coral reefs, mangroves, and seagrass beds are essential for supporting fish populations and providing livelihoods for small-scale fishers.

“ *Loss of Livelihoods and Food Security*: Climate change can undermine the livelihoods and food security of small-scale fishers, who rely on fishing for income and sustenance.

“ *Shifting Fish Stocks and Species Composition*: Climate change is causing shifts in the distribution and abundance of fish stocks, impacting the availability of species traditionally targeted by small-scale fishers

“ *Vulnerability to Extreme Weather Events*: Small-scale fisheries are highly vulnerable to extreme weather events such as storms, hurricanes, and typhoons, which can damage fishing infrastructure.

“ *Limited Resources and Capacity*: Small-scale fishers often lack the financial resources, technical expertise, and institutional support needed to implement effective climate change adaptation measures.

Any other? _____

26. How is local knowledge a barrier to climate change Adaptation Strategies for small-scale fisheries in Liberia? Tick to the list below.

“ *Lack of Documentation and Transmission*: If this knowledge is not adequately documented or transmitted to younger generations, it may be lost over time, reducing its potential contribution to climate change adaptation efforts.

“ *Resistance to Change*: Resistance can hinder the implementation of climate change adaptation measures, mainly, a lack of understanding between external actors and local stakeholders.

“ *Limited Recognition and Integration*: Decision-makers might prioritize scientific or external knowledge over traditional knowledge, leading to the neglect of valuable insights from local fishers who have intimate knowledge of their environment and its changes over time.

“ *Mismatch with External Interventions*: These interventions might not align with or adequately consider local knowledge systems, resulting in strategies that are ineffective in Liberia.

“ *Power Dynamics and Marginalization*: Marginalization can prevent their insights from being incorporated into adaptation strategies, leading to solutions that do not address climate change.

Any other? _____

<i>No.</i>	<i>Statements</i>	<i>SD</i>	<i>D</i>	<i>N</i>	<i>A</i>	<i>SA</i>
27.	The integration of local knowledge is a challenge to climate change adaptation					
28.	The Lack of documentation is a challenge to local knowledge on adaptation to climate change strategies by small-scale fisheries.					
25.	Lack of adaptation strategies by small-scale fisheries					
29.	Lack of awareness and understanding of climate change impacts to incorporating local knowledge and adaptation strategies for small-scale fisheries?					
30.	Lack of policy to adapt to climate change in the fisheries sector					
31.	Capacity building has been provided for small-scale fisheries institutions on climate change adaptation strategies					
32.	Limited coping strategies for small-scale fisheries to adapt to climate change in Liberia					
33.	The issue of political will in climate change adaptation strategies has been a problem					
34.	Overfishing by humans has had a more significant impact on fish populations than environmental changes.					
35.	Local knowledge transfer has led to poor implementation of climate change adaptation strategies by small-scale fisheries					

Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (by ICMJE criteria for authorship)

<i>Contribution</i>	<i>Author 1</i>	<i>Author 2</i>	<i>Author 3</i>
Conceived and designed the research or analysis	Yes	Yes	Yes
Collected the data	Yes	No	No
Contributed to data analysis & interpretation	Yes	Yes	No
Wrote the article/paper	Yes	No	No
Critical revision of the article/paper	No	Yes	Yes
Editing of the article/paper	No	Yes	Yes
Supervision	No	Yes	Yes
Project Administration	Yes	No	No
Funding Acquisition	Yes	No	No
Overall Contribution Proportion (%)	50	30	20

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Research involving human bodies or organs or tissues (Helsinki Declaration)

The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

Research involving animals (ARRIVE Checklist)

The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

Research on Indigenous Peoples and/or Traditional Knowledge

The author(s) solemnly declare(s) that this research has not involved Indigenous Peoples as participants or respondents. The contexts of Indigenous Peoples or Indigenous Knowledge were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

Research involving Plants

The author(s) solemnly declare(s) that this research has involved the plants for experiment and field studies. Some contexts of plants are also indirectly covered through literature review. Thus, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

Research Involving Local Community Participants (Non-Indigenous) or Children

The author(s) solemnly declare(s) that this research has directly involved local community participants or respondents belonging to non-Indigenous peoples. This study has not involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people were only indirectly covered through literature review. Therefore, prior informed consent (PIC) of the respondents or Self-Declaration in this regard is appended.

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

The author(s) has/have NOT complied with PRISMA standards. It is not relevant in case of this study or written work.

Competing Interests/Conflict of Interest

Author(s) has/have no competing financial, professional, or personal interests from other parties or in publishing this manuscript. There is no conflict of interest with the publisher or the editorial team or the reviewers.

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INFORMATION AND CONSENT FORM FROM RESPONDENTS
(Non-Indigenous Respondents)

This form was translated into local language for the respondents

**Title of the Research: Barriers to Integration of Local Knowledge in Climate
Adaptation Strategies for Liberia's Small-Scale Fisheries**

Principal Researcher: Dekontee Oliver Saytarkon
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Kenya, Lower Kabete Campus.

A) INFORMATION TO PARTICIPANTS

1. Objectives of the research

The objectives of this study was to examine barriers to integrating local knowledge into climate adaptation efforts, focusing on three key fishing areas: West Point, Marshall, and St. Paul Bridge in Liberia.

2. Participation in research

The researcher will ask you several pertinent questions. This interview will be recorded in written form and should last about 50-60 minutes. The location and timing of the interview will be determined by you, depending on your availability and convenience.

3. Risks and disadvantages

There is no particular risk involved in this project. You may, however, refuse to answer any question at any time or even terminate the interview.

4. Advantages and benefits

You will receive intangible benefits even if you refuse to answer some questions or decide to terminate the interview. You will also contribute to a better understanding of the barriers to integrating local knowledge in climate change adaptation strategies among small-scale fisheries in Liberia.

5. Confidentiality

Personal information you give us will be kept confidential. No information identifying you in any way will be published. In addition, each participant in the research will be assigned a code and only the researcher will know your identity.

6. Right of withdrawal

Your participation in this project is entirely voluntary and you can at any time withdraw from the research on simple verbal notice and without having to justify your decision, without consequence to you. If you decide to opt out of the research, please contact the researcher at the telephone number or email listed below. At your request, all information concerning you can also be destroyed. However, after the outbreak of the publishing process, it is impossible to destroy the analyses and results on the data collected.

B) CONSENT

Declaration of the participant

- ⇒ I understand that I can take some time to think before agreeing or not to participate in the research.
- ⇒ I can ask the research team questions and ask for satisfactory answers.
- ⇒ I understand that by participating in this research project, I do not relinquish any of my rights, including my right to terminate the interview at any time.
- ⇒ I have read this information and consent form and agree to participate in the research project.
- ⇒ I agree that the interviews be recorded in written form by the researcher: Yes () No ()

Signature of the participant : _____ Date : _____

Surname : _____ First name : _____

Researcher engagement

I explained to the participant the conditions for participation in the research project. I answered to the best of my knowledge the questions asked and I made sure of the participant's understanding. I, along with the research team, agree to abide by what was agreed to in this information and consent form.

Signature of the researcher :



Date : 02-03-2024

Surname: Saytarkon

First name: Dekontee

- ⇒ Should you have any questions regarding this study, or to withdraw from the research, please contact Mr. Dekontee Oliver Saytarkon by e-mail oliversaytarkon@gmail.com
- ⇒ If you have any concerns about your rights or about the responsibilities of researchers concerning your participation in this project, you can contact Mr. Austin Saye Wehye, Director- Research & Statistics, National Fisheries and Aquaculture Authority (NaFAA)
Email: awehye@nafaa.gov.lr / austinwehye@yahoo.com